MULTIPLE ELECTRIC MOTOR DRIVEN AIR COMPRESSOR

FIELD OF THE INVENTION:

[0001] The present invention relates to a multiple electric motor driven air compressor, for example, for gasoline or diesel engine powered vehicles.

BACKGROUND AND PRIOR ART:

[0002] There is a problem with previous electrical driven air compressor designs when used as an engine supercharger, in that a single electric motor is ineffective in providing the required power needed to produce the air flow (CFM) and minimum boost pressure (at least 5 psi) that results in a noticeable horsepower (HP) increase. A single electric motor is limited by the motor's amperage draw (WATTS) and to the capacity of a vehicle's battery(s) and electrical system (i.e. battery cables).

[0003] The present invention uses existing and well known positive displacement air compressor (supercharger) theory and design, then combines that with two or more high power electric motors. The multiple electric motors have drive gears affixed to one end inside a common housing which then drives gears that are on a common shaft with the supercharger's rotors. The supercharger's rotors are turned by gears which are in contact with the gears that are fixed to the multiple electric motors mounted to a common housing. Previous electrical

superchargers have used a single electric motor connected to a centrifugal compressor on a common fixed shaft.

[0004] Any engine's power output can be increased an additional amount by forcing air into the engine at pressures above atmospheric (14.7 PSI). Any given engine will experience an average one hundred percent (100%) increase in power with the addition of a second atmosphere of pressure (14.7 PSI + 14.7 PSI) to the intake manifold. To create additional pressure (boost) and additional airflow (CFM) through an engine takes considerable power. For example- a 2.0 liter 4-CYL engine that turns 6000 RPM will flow 216 CFM. To flow 50% more air (324 CFM) and 50% more pressure (7.4 PSI) would require 14 HP. 14 HP = 10,444WATTS (14 HP x 746 WATTS/HP = 10,444 WATTS). Using common electrical laws 10,444 WATTS is equal to 870 AMPS (WATTS = VOLTS x AMPS). Therein lies one of the problems with the prior art. It is virtually impossible to get 870 AMPS at 12 volts to an electric motor because of battery and battery cable limitations, as well as the motor. This problem is evident – a single 12 volt electric motor sufficient to make 14 HP would be extremely heavy, very large, and would make fitment an impossibility on most vehicles. One example, the General Electric 15 HP electric motor (Catalog No. V3158) weighs 340 pounds. To design and use a single 14 HP 12 volt electric motor is impractical.

[0005] The prior art has additional shortcomings in the vehicle's battery(s) and cables used to power the supercharger. Standard automotive batteries are rated using cold cranking amps

Inventor: Thomas Geoff Knight

(CAA). Factory supplied standard automotive batteries are typically rated at 500-700 CCA. The

battery cables pose an additional limitation. The largest standard automotive battery cable is the

#2 size, rated at 205 AMPS continuous or 275 AMPS momentary. 205 AMPS x 12 V = 2460

WATTS, or 3.3 HP. The typical automotive starter is rated at 1-1.5HP, so the #2 cable is

adequate for that application. The present positive displacement supercharger design draws

14,000 WATTS (18 HP) and 1166 AMPS at 12 volts. It is therefore impossible for a single

battery and set of battery cables to provide the necessary WATTS to generate 18HP.

SUMMARY OF INVENTION

[0006] One purpose of the present invention is to allow for electric supercharger

performance previously unattainable. A single electric motor is limited by size, weight,

amperage, vehicle's battery and battery cable system. By using multiple (two or more) electric

motors combined with multiple batteries and battery cables (each electric motor has a dedicated

battery and cable set), the previous power limitations are overcome.

[0007] The present invention obtains the desired higher than atmospheric pressure that

results in a large increase in horsepower(HP) on engines.

180001 The present invention utilizes two (2) or more 3000+ WATT high RPM (8000+RPM)

motors, each motor having a drive gear affixed to one end, on a common mounting plate/housing

with parallel shafts turning gears which turn the supercharger's rotors. It is necessary to have

Docket No. K085881

Docket No. Kussssi

Inventor: Thomas Geoff Knight

high supercharger rotor rotational speeds to create 5+ PSI boost pressure on smaller engines.

Larger engines would of course require a larger supercharger and additional motors or more

powerful motors.

[0009] One embodiment of the present invention provides a compact design of three electric

motors making the complete supercharger fifteen (15) to sixteen (16) inches long, eight (8)

inches in diameter, and weighing approximately 38 pounds. This is similar in size to the

currently available automotive superchargers.

[0010] One embodiment of the present invention incorporates the use of three separate

batteries to power the supercharger unit - one battery per electric motor, with one complete set of

battery cables per battery/electric motor. The three sets of battery cables are to be larger than

production battery cables - 2/0 cables rated at 325 AMPS (continuous use) per cable. The 2/0

cables have a momentary rating of 450 AMPS (30 seconds) per cable, allowing for 1350 AMPS

or 16,200 WATTS. (450 AMPS x 3 batteries x 12 volts).

[0011] One embodiment of this invention uses two or more electric motors and gears to

power a roots type positive displacement supercharger.

[0012] One embodiment of this invention use two or more electric motors and gears to power

a screw type positive displacement supercharger.

Docket No. K085881

Inventor: Thomas Geoff Knight

[0013] One embodiment of this invention uses two or more electric motors and gears/pulleys

to power a centrifugal supercharger.

[0014] By using two or more motors and a variety of supercharger components, a system can

be made for a specific application-such as a motorcycle, snowmobile, watercraft, up to a semi-

tractor trailer truck or large industrial stationary engine. In addition, a standard size could be

produced to cover a large segment of the most popular vehicles. Because the horsepower and

watts would stay constant, a smaller engine could receive higher boost pressures (PSI), while a

larger engine would receive more air flow (CFM) but less boost pressure(PSI). Known fan laws

state that if horse power (HP) is constant, and pressure (PSI) drops, then air flow (CFM)

increases. Conversely, as boost pressure (PSI) increases then air flow(CFM) is reduced. (HP = P

x CFM).

[0015] Another object of the present invention is to make available, at a reasonable cost, a

high performance electric supercharger. To this end, the majority of components are already

available. With suitable modification, the supercharger housings and supercharger rotors are

standard supercharger components from Eaton, Magnuson Products, Autorotor, Whipple, etc.

The electric motors can be high amperage 6 + Volt aftermarket motor modified for this

application from Delco-Remy, Nippon-Denso, etc. The drive gears can be, but are not limited to

Docket No. K085881

Inventor: Thomas Geoff Knight

steel, aluminum, or any composite. The battery cables can be standard high AMP 2/0 welding

cable, and the batteries can be automotive type available at any auto parts store.

[0016] U.S. Pat. No. 2,839,038 describes using one (1) or two (2) electric motors to turn a

centrifugal supercharger. U.S. Pat. No.5,224,459 by Middlebrook uses internal gears with two

parallel shafts powered by the vehicle's engine crankshaft to power a centrifugal supercharger.

This requires engine oil to be supplied to the gears and bearings. U.S. Pat. No. 5,638,796 by

Adams III uses a 10 HP, 50-100 Volt, 60,000 RPM electric motor to power a centrifugal

supercharger. As seen by the provided explanations, 10 HP is not sufficient to make adequate

boost pressure (PSI) and airflow (CFM). In addition, the cost of the electric motor, controller,

voltage step-up transformer, and the required additional batteries to produce 50-100 volts make

that design impractical. However, this invention solves that problem.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Figure 1 shows a side perspective of one embodiment of the multiple electric motor

powered supercharger of the present invention.

[0018] Figure 2 provides an exploded perspective of one embodiment of the multiple electric

motor driven supercharger of the present invention.

Docket No. K085881

Inventor: Thomas Geoff Knight

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[0019] Figure 3 provides a side view of one embodiment of the multiple electric motor

driven supercharger of the present invention with three electric motors.

[0020] Figure 4 shows an end view of one embodiment of the multiple electric motor driven

supercharger of the present invention with three electric motors.

[0021] Figure 5 shows the gear arrangement of one embodiment of the multiple electric

motor driven supercharger with three electric motors.

DETAILED DESCRIPTION

[0022] Throughout the specification and claims, the terms "air compressor" and

"supercharger" are used interchangeably and refer to the component that supplies air under

pressure to the cylinders of an internal combustion engine.

[0023] Throughout the specification and claims, the terms "boost" and "pressure" are used

interchangeably and refer to the amount of air pressure produced by the supercharger.

[0024] Throughout the specification and claims, the terms "gears" and "pulleys" are used

interchangeably to refer to a part, such as a disc, wheel, or section of a shaft, for supporting,

guiding, or transmitting force.

Docket No. K085881

Inventor: Thomas Geoff Knight

[0025] Throughout the specification and claims, the term standard 2 gauge wire indicates a

battery cable rated at 205 amps continuous, or 275 amps momentary.

[0026] Throughout the specification and claims, the term standard 2/0 gauge wire indicates a

battery cable rated at 325 amps continuous, or 450 amps momentary.

[0027] Throughout the specification and claims,

"pounds per square inch" are depicted as "psi,"

"horsepower" is depicted as "hp,"

"revolutions per minute" are depicted as "rpm," and

"1,000" is depicted as "K."

[0028] Figures 1 through 5 provide several embodiments of the present invention, in which

like parts are indicated by like numbers. As the details are the clearest in the exploded

perspective of Figure 2, the details of one embodiment will be described using that Figure as

reference.

[0029] Figure 2 shows an exploded perspective of one embodiment of the multiple electric

motor driven supercharger (100) of the present invention. The multiple electric motor driven

supercharger (100) contains three electric motors (1, 2, 3). These electric motors (1, 2, 3) can be

any high amp (6 volt or more) electric motors, modified for this application. Each electric motor

Docket No. K085881

Inventor: Thomas Geoff Knight

speeds of 8,000 RPM or higher.

(1, 2, 3) is connected to a direct current energy source (not shown). The direct current energy source (not shown) can be any object capable of producing approximately twelve (12) volts, such as a standard twelve-volt battery. Each electric motor (1, 2, 3) should be capable of rotational

[0030] The three electric motors (1, 2, 3) of the multiple electric motor driven centrifugal air compressor (100) shown in Figure 2 are attached to three gears (6, 7, 8) through a gear housing plate (4). The three gears (6, 7, 8) can be connected to the three electric motors (1, 2, 3) by bolts, press fitting, or any suitable means. The electric motors (1, 2, 3) are mounted to the gear housing plate (4) by electric motor mounting bolts (5). However, any known connection mechanism can be used to connect the electric motors (1,2,3) to the gear housing plates (4).

[0031] The gears (6, 7, 8) are protected from the environment by the combination of gear housing plate (4), gear housing spacer (9), and supercharger rotor bearing plate (10). Supercharger rotor bearing plate (10) is connected to gear housing spacer (9) and gear housing plate (4) by gear housing bolts (18). However, as described for the electric motor mounting bolts (5), any known connection mechanism can be used. The gear housing plate (4), gear housing spacer (9) and the supercharger rotor bearing plate (10) are comprised of normal engine materials, including, but not limited to aluminum, steel or composites. Depending upon the application, the gear housing plate (4), gear housing spacer (9), and the supercharger rotor

Docket No. K085881

Inventor: Thomas Geoff Knight

bearing plate (10) comprise an average total width of 8 inches and an average total thickness of

2 inches.

[0032] Electric motor (1) drives gear (6). Electric motor (2) drives gear (7). Electric motor

(3) drives gear (8). Gears (6, 7, and 8) drive supercharger rotor gears (11, 12). The gears (6, 7,

8, 11, 12) are comprised of aluminum, steel, or any suitable composite. In the alternative, gears

(6, 7, 8) can drive supercharger rotor gears (11, 12) by means of one or more two-sided drive

belts (not shown). In that embodiment, the gears (6, 7, 8) can be cog drive or grooved pulleys.

The drive belt can be V-belt, multi-groove V-belt, toothed timing belt, or any suitable belt for

this application. The belt can be constructed of rubber, urethane, fiberglass stranded, or any

suitable materials.

[0033] Supercharger gear (11) is connected to supercharger rotor (15) and supercharger gear

(12) is connected to supercharger rotor (16). Supercharger rotors (15, 16) are supported at one

end by supercharger rotor shaft bearings (13), which are mounted in supercharger rotor bearing

plate (10). Supercharger rotors (15, 16) are supported at the opposite end by supercharger rotor

housing bearings (19), which are mounted in supercharger rotor housing (17).

[0034] Electric motors (1, 2, 3) power supercharger rotors (15, 16) of the multiple electric

motor driven supercharger (100) of the present invention. Supercharger rotors (15, 16) are

powered by the electric motors (1, 2, 3) connected to gears (4, 5, 6), which contact and mesh

Inventor: Thomas Geoff Knight

with supercharger gears (11, 12). The resultant power available to multiple electric motor driven

supercharger (100) is greater than experienced by previous superchargers.

[0035] Figure 1 provides a side perspective of one embodiment of the multiple electric motor

powered supercharger (100) of the present invention.

[0036] Figure 3 provides a side view of one embodiment of the multiple electric motor

driven supercharger (100) of the present invention containing three electric motors (1, 2, 3),

gears (6, 7, 8), gear mounting plate (4), and the electric mounting bolts (5).

[0037] Figure 4 provides an end view of one embodiment of the multiple electric motor

driven supercharger (100) of the present invention with three electric motors (1, 2, 3) and gear

mounting plate (4).

[0038] Figure 5 provides an internal view of the gear arrangement of one embodiment of the

multiple electric motor driven supercharger (100) of the present invention with three gears (6, 7,

8), supercharger rotor gears (11, 12) and gear mounting plate (4).

[0039] The Figures have been provided for exemplary purpose only. It is to be understood

that the invention is not limited to the embodiments disclosed in the Figures, but is intended to

cover various modifications and equivalent arrangements included within the spirit of the

Docket No. K085881

Inventor: Thomas Geoff Knight

invention, which are set forth in the appended claims, and which scope is to be accorded the broadest interpretation so as to encompass all such modifications and equivalent structures.

Docket No. K085881

Inventor: Thomas Geoff Knight

- 1-Electric Motor
- 2-Electric Motor
- 3-Electric Motor
- 4-Gear Housing Plate (motor side)
- 5-Electric Motor Mounting Bolt (s)
- 6-Gear 1
- 7-Gear 2
- 8-Gear 3
- 9-Gear Housing Spacer
- 10-Supercharger Rotor Bearing Plate
- 11-Supercharger Rotor Gear #1
- 12-Supercharger Rotor Gear #2
- 13- Rotor Shaft Bearing(s)
- 14-Potor Shaft Seal(s)
- 15-Supercharger Rotor#1
- 16-Supercharger Rotor#2
- 17-Supercharger Rotor Housing
- 18-Gear Housing Bolt(s)
- 19-Supercharger Rotor Housing Bearing(s)
- 100- Multiple Electric Motor Driven Supercharger